GS PAPER 2- GOVERNMENT POLICIES AND INTERVENTIONS FOR DEVELOPMENT IN VARIOUS SECTORS AND ISSUES ARISING OUT OF THEIR DESIGN AND IMPLEMENTATION.

Challenges in adopting electric buses in India

The article discusses India's new PM E-DRIVE scheme, which funds electric buses. It highlights concerns over private bus operators being excluded from subsidies. It also mentions challenges like financing, charging infrastructure, and suggests innovative models like Battery-as-a-Service to promote private electric bus adoption.

What is the PM E-DRIVE Scheme?

1. The PM Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) scheme aims to boost electric vehicle use in India.
2. It provides ₹4,391 crore for subsidies to help buy 14,028 electric buses in nine cities, focusing on strengthening public transport's shift to electric vehicles (EVs).
3. Private bus operators are not included in the PM E-DRIVE scheme or other major national subsidy programs.
4. This exclusion raises concerns about scaling electric mobility beyond state-run buses, especially since private buses make up 93% of India's total bus fleet.

What Are the Challenges in Adopting Electric Buses?

1. The International Council on Clean Transportation (ICCT) identifies financing as a major hurdle for private operators due to high upfront costs and uncertainties like battery life.
2. Despite electric buses being potentially more profitable over their service life, high interest rates, loan costs and low resale value make them less viable initially.
3. Charging infrastructure is another challenge, as most private operators cannot afford the high costs of land for charging stations.

What Should be Done?

1. **Offer Financial Support**: Provide interest subsidies, longer loan tenures, and credit guarantees to reduce financial risks, as suggested by the ICCT.
2. **Expand Charging Infrastructure**: Set up shared charging stations in cities and on key highways to support private operators managing smaller fleets, given high land and power costs.
3. **Implement Battery-as-a-Service (BaaS)**: Adopt BaaS to separate battery ownership from vehicles, lowering costs. Models like battery swapping and usage-linked leasing, seen in China, Kenya, and through Macquarie's Vertelo in India, could boost private electric bus adoption.

What Are the Potential Benefits?

1. **Reduces Fuel Costs:** Electric buses reduce fuel costs for intercity travel, which serves 22.8 crore daily passengers and covers 57% of total ridership.
2. **Supports Sustainable Routes:** Around 40% of intercity trips fall within 250-300 km, fitting electric buses' single-charge range.
3. **Offers Long-Term Savings:** Despite high initial costs, electric buses can be more profitable over time compared to diesel.

GS PAPER 3- CHANGES IN INDUSTRIAL POLICY AND THEIR EFFECTS ON INDUSTRIAL GROWTH. AND GS2-GOVERNANCE– GOVERNMENT POLICIES AND INTERVENTIONS FOR DEVELOPMENT IN VARIOUS SECTORS AND ISSUES ARISING OUT OF THEIR DESIGN AND IMPLEMENTATION

India's biopharmaceutical and biosimilar industry

The article discusses India's growing biopharmaceutical industry and the challenges of patent evergreening, which keeps drug prices high. It highlights efforts like the National Biopharma Mission to boost biosimilar production and calls for stronger patent opposition.

What is the current status of India's biopharmaceutical industry?

1. India's biopharmaceutical industry is valued at $60 billion, ranking as one of the fastest-growing globally.
2. The country has improved in innovation, **moving from 81st to 39th in the Global Innovation Index since 2015.**
3. India is a leader in biosimilars, with 98 approved products, including those sold in the US; it was the **first to approve a Hepatitis B biosimilar.**

What are biopharmaceuticals and biosimilars?

1. **Biopharmaceuticals are medicines derived from living cells, such as yeast or bacteria, unlike conventional drugs made from chemicals.**
2. They are crucial in treating chronic illnesses like cancer, diabetes, cardiovascular disease, and autoimmune diseases.
3. **Biosimilars are medicines made from living cells, similar to original biologic drugs.** They offer the same safety and effectiveness as the original biologic.
4. India's biosimilars market was valued at $349 million in 2022 and is projected to grow by 25.2% annually, reaching $2,108 million by 2030.

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How is the Global Landscape on Biosimilar Patents?

1. In the US, 74% of new patents are associated with existing drugs, extending their monopoly period. Nearly 80% of top-selling drugs are protected by extended patents.
2. In Europe, the approval process for biosimilars is simpler, especially in countries like Germany and the UK, leading to cost savings and wider access to medicines.

What incentives have been implemented to support India's biopharmaceutical industry?

1. **National Biopharma Mission (NBM):** The $250 million NBM, co-funded by the World Bank, supports 150 organizations and 300 MSMEs. It has established 21 research facilities crucial for COVID-19 vaccine trials, boosting India's biopharma industry.
2. **Make in India Initiative:** This initiative supports domestic manufacturing, including the biopharmaceutical sector.
3. **Biopharma Product Development:** NBM funding led to 18 successful products, benefiting India's healthcare goals.

What are the challenges facing India's biopharmaceutical industry?

1. **Patent Evergreening**: Multinational companies extend monopoly by making minor changes to drugs nearing patent expiry. Roche, for example, extended the patent exclusivity of trastuzumab (a biologic used to treat breast cancer) by introducing a subcutaneous version of the drug just as the original patent was nearing its expiration.
2. **Market Access Limitations**: India holds only 3% of the global biosimilars market due to barriers like patent extensions, limiting affordable options for patients.
3. **Delayed Biosimilar Adoption**: Unlike the EU, where biosimilars are widely accepted, Indian regulations need enhancement for quicker approval, as seen in Europe, where countries like Germany and the UK save costs with simpler approvals.
4. **Regulatory Challenges:** India's robust patent laws, like Section 3(d) of the Patents Act, aim to curb evergreening, yet about 72% of granted pharmaceutical patents in India are for minor or secondary innovations, highlighting the need for more stringent patent scrutiny.

GS PAPER 3 – ACHIEVEMENTS OF INDIANS IN SCIENCE & TECHNOLOGY; INDIGENIZATION OF TECHNOLOGY AND DEVELOPING NEW TECHNOLOGY

Transforming India's Soap Industry Through Sustainable Initiatives

This article discusses India's initiatives to promote sustainable development through research and bio-based industries. It highlights reducing palm oil in soaps, using alternative materials, and regulatory changes for eco-friendly products, encouraging partnerships between academia and industry.

What Are India's New Initiatives for Sustainable Development?

1. India has introduced the **Anusandhan National Research Foundation** (ANRF) and the BioE3 (Biotechnology for Economy, Environment and Employment) policy to encourage research and develop sustainable bio-based industrial models.
2. These initiatives aim to transform chemical-based industries to more sustainable ones, supporting India's commitment to climate action and sustainable development.

How Is the Soap Industry Impacting the Environment?

1. The global soap industry heavily relies on palm oil, which is mainly produced in Borneo, Sumatra, and the Malay Peninsula.
2. This production contributes to significant deforestation, biodiversity loss, and greenhouse gas emissions.
3. About 90% of palm oil plantations are located in these regions, and palm oil satisfies 40% of the world's vegetable oil demand.

What Are the Alternatives to Palm Oil in Soap Production?

1. Emerging technologies are exploring ways to replace or reduce palm oil in soap production.
2. Innovations include synthetic biotechnologies that can mimic the fatty acids in palm oil, which are essential for the soap's structure and cleansing properties.
3. Alternatives like plant-based polysaccharides could potentially replace the structuring agents in soap, enhancing environmental sustainability.

How Is India Supporting Sustainable Palm Oil Production?

1. India's National Mission on Edible Oils-Oil Palm aims to increase the oil palm production area to 10 lakh hectares and boost crude palm oil production to 11.20 lakh tonnes by 2025-26.
2. The mission emphasizes sustainable practices, including the policy of 'No Deforestation, No Peat', and supports smallholder farmers through regenerative agriculture practices.

What Regulatory Changes Are Needed?

1. **Move Away from Fatty Material-Based Standards**: Current soap grades rely on fatty content, misleading consumers and regulators to equate higher fatty material with better quality. Research suggests this doesn't necessarily improve product quality.

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2. **Mandate Sustainability Labels**: Introducing mandatory sustainability labeling would help consumers make informed, eco-friendly choices based on a product's sourcing and production practices.
3. **Support Bio-Based Alternatives**: Regulatory standards should encourage using bio-based materials, like plant-based polysaccharides, to reduce the reliance on palm oil in soap production, promoting sustainability.

GS PAPER 3-INDIAN ECONOMY-INFLATION

High vegetable inflation makes it hard for the RBI to lower interest rates

The article explains that high vegetable inflation, especially from tomatoes, onions, and potatoes, makes it hard for the RBI to lower interest rates. Structural issues in agriculture, outdated food weights in inflation calculations, and poor supply chains worsen the problem.

Why is the RBI not reducing repo rates?

1. The RBI is hesitant to reduce repo rates due to high inflation, which remains above the comfortable level of 4%.
2. In September, Consumer Price Index (CPI) inflation reached 5.5%, with food inflation climbing above 9.2%.
3. This is primarily due to rising vegetable prices, particularly tomatoes, onions, and potatoes (TOP), which have impacted the CPI significantly.

How does food inflation affect overall inflation?

1. Food inflation drives overall inflation due to outdated weights assigned to food in the CPI basket. 2. Food and beverages make up 45.9% of the CPI, with food alone accounting for 39%.
2. These weights, based on 2011-12 data, need updating to reflect current consumption. The 2022-23 survey suggests a 5-6 percentage point reduction, which could help better represent today's spending patterns.

What factors are driving high vegetable prices?

1. Vegetable inflation reached 36% in September, contributing 42.8% to overall CPI inflation. The prices of tomatoes, onions, and potatoes surged dramatically, driven by:
   Tomatoes: Price increases of 42.4% due to crop delays from heavy rains and white fly infestations in Karnataka, impacting key production areas.
   Onions: Prices rose by 66.2%, with storage losses reported in Maharashtra and delayed crop arrivals due to rain.
   Potatoes: Increased prices by 65.3%, as stored rabi crops began perishing in October.
2. **Operation Greens,** initiated in 2018 to stabilize prices of TOP vegetables, has been diluted to include all fruits and vegetables, losing its focus. This has led to ongoing supply disruptions and post-harvest losses, with potatoes facing 18-26% losses, onions 25%, and tomatoes 11.6%.

What should be done?

1. Short-term measures, such as the 40% export duty on onions, address immediate consumer concerns but don't solve the root issue. For lasting stability, policies suggest **processing surplus vegetables** into products like tomato paste, onion flakes, and dehydrated potatoes to reduce wastage and boost income for farmers. Examples include Jain Irrigation's onion dehydration efforts with farmers.
2. The RBI cannot manage food inflation through repo rates alone, as it lacks authority over agricultural policies. So there is a need for a **dedicated agency to manage the supply and pricing of tomatoes, onions, and potatoes effectively.**

SCIENCE AND TECHNOLOGY GS PAPER-III

India's Space Planning

India's space program, led by the Indian Space Research Organisation (ISRO), is expanding its horizons with a series of ambitious missions, new technologies, and partnerships, signaling a new phase in space exploration.

India's Space Planning highlights:

- Gaganyaan Missions: Four human spaceflight missions and one uncrewed flight are part of the Gaganyaan program, progressing towards India's human spaceflight capability.
- Bharatiya Antariksh Station: Four test missions are planned, aiming for India's first space station launch, the Bharatiya Antariksh Station, by 2028.
- Next Generation Launch Vehicle (NGLV): Approved for ₹8,240 crore, the NGLV will be developed in partnership with the private sector, enabling it to handle operational flights.
- Venus Orbiter Mission: Scheduled for 2028, this ₹1,236 crore mission aims to study Venus's atmospheric and surface conditions.
- Chandrayaan-4 (2027): A moon sample-return mission, valued at ₹2,104 crore, with plans to collect lunar soil for Earth analysis.
- LUPEX with Japan: Collaborative Lunar Polar Exploration Mission (LUPEX) will involve a new lander designed for potential crewed missions in the future.
- Space-Based Surveillance (SBS-3): A comprehensive satellite network (21 by ISRO and 31 by private firms) for advanced surveillance capabilities at ₹26,968 crore.

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- NISAR & Proba-3 Satellites: NISAR will focus on Earth observation (launch by early 2025), while Proba-3 will study the Sun's corona, scheduled for launch in November 2024.
- Private Sector Involvement: Initiatives include green propulsion systems by Manastu Space, low-orbit satellites by Bellatrix Aerospace, and satellite assembly by Ananth Technologies.

Challenges in India's Space Planning:

- Commercial market access: India's limited share (2.6%) in the global space economy restricts its commercial space ventures, including satellite manufacturing and high-altitude platforms.
- Technological dependency: Ranking 7th globally in satellite count, India still relies on imports for advanced launch vehicle components, affecting self-sufficiency in critical technologies.
- Policy and legal gaps: The absence of a comprehensive space policy delays regulatory developments, hindering structured growth and commercial engagement in the sector.
- Budget constraints: With only 0.05% of GDP allocated to space, India's budget is modest compared to countries like the US (0.25%), limiting its scope for high-cost missions.
- Geopolitical considerations: Collaborations, like the Artemis Accords, require diplomatic balancing, particularly amid geopolitical tensions involving China and other spacefaring nation.

Way forward:

- Boost private sector engagement: Involving private companies in satellite production and other space ventures aligns with global trends and enhances India's commercial capabilities.
- Strengthen human spaceflight program: Investing in astronaut training and infrastructure can prepare India for crewed missions, marking a milestone in indigenous human spaceflight.
- Increase budget allocation: Moving from cost-effective approaches to substantial investments will support India's ambitious space goals and complex missions.
- Legal and policy framework development: Creating clear, forward-looking policies will ensure safe and sustainable space expansion, addressing both commercial and security needs.
- Expand international partnerships: Strengthening cooperation with global space agencies supports India's goals while promoting peaceful and inclusive space exploration.

PRELIM FACTS

1.Pandemic Fund

The Union Government of India has launched a $25 million project to boost animal health security in partnership with the Asian Development Bank (ADB), World Bank, and Food and Agriculture Organization (FAO).

About Pandemic Fund:

- **Fund size and origin:** A $25 million initiative established under the G20 Pandemic Fund during Indonesia's G20 presidency in **2022.**
- **Objective:** Enhance pandemic preparedness in low- and middle-income countries by improving response capacity to animal health risks.
- **Implementing partners:** Asian Development Bank (ADB), World Bank, and Food and Agriculture Organization (FAO).

Purpose and rationale:

- **Preventing zoonotic outbreaks:** Address the animal origin of zoonotic diseases, with 5 of 6 WHO-declared public health emergencies having animal origins.
- **Reducing economic impact:** Mitigate socio-economic damage caused by zoonotic outbreaks, like SARS and avian flu, which caused global losses of $50 billion and $30 billion, respectively.

Key Interventions:

- **Laboratory upgrades:** Expand and improve animal health labs and vaccine production facilities.
- **Enhanced surveillance:** Strengthen early warning systems for better outbreak detection and timely intervention**.**
- **Data system upgrades:** Improve data management and analysis for better risk assessment and decision-making.
- **Institutional capacity building:** Establish a disaster management framework tailored for the livestock sector, addressing capacity needs at national and regional levels.

Zoonotic diseases:

- **Definition:** Diseases that can be transmitted from animals (domesticated or wildlife) to humans, often facilitated by close animal-human interactions.
- **Risk statistics:** Over 60% of pathogens affecting humans originate from animals, with 75% of emerging human diseases linked to animal sources.

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- **Examples and impact:** Mosquito-borne diseases (e.g., dengue from Aedes aegypti), avian influenza, and rabies are zoonotic diseases. Climate change increases the frequency and range of these diseases.

2.Tardigrades

Researchers have discovered the mechanisms behind the extraordinary radiation resistance of a newly identified species of **tardigrades, *Hypsibius henanensis*,** which may have future applications in space travel, nuclear cleanup, and cancer therapy.

About Tardigrades:

- **Habitat:** Found globally in terrestrial, marine, and freshwater environments, from extreme Arctic cold to Antarctic depths and high altitudes.
- **Extreme survivors:** Known for enduring extreme radiation, temperatures ranging from 150°C to -272°C, and decades without food or water.
- **Unique physiology:** These tiny, eight-legged, multicellular creatures can revive from a dried, lifeless state even after several years.
- **Size and structure:** Microscopic but multicellular, they are among the most resilient life forms on Earth, earning nicknames like **"water bears"** and **"moss piglets"** due to their appearance and habitat preferences.
- **Tardigrades' radiation resistance:**
  - **Genetic adaptation:** Hypsibius henanensis has 14,701 genes, with 30% unique to tardigrades, that activate under radiation to protect and repair DNA.
  - **DNA repair mechanisms:** Uses a specific protein, TRID1, to quickly repair DNA double-strand breaks caused by radiation.
  - **Mitochondrial and DNA repair proteins:** Produces proteins crucial for mitochondrial function and DNA repair, enhancing survival after radiation exposure.
  - **Antioxidant pigments (Betalains):** Produces betalains that neutralize harmful chemicals generated by radiation, preventing cellular damage.

3.Federalism

Context: Chief Justice of India recently highlighted the evolving role of federalism in promoting democracy and upholding constitutional ideals. At the Loksatta Annual Lecture, he stressed that modern challenges like **climate change, AI, and cybercrime** require Union and state collaboration, emphasizing the need for greater synergy.

These lines from his speech capture CJI Chandrachud's vision of a dynamic and cooperative federalism:

- "Federalism should foster democracy, equality, liberty, dignity, and fraternity."
- "Modern challenges like climate change and cybercrime go beyond traditional federal boundaries."
- "The Constitution was intended to be transformative, not static."
- "Indian federalism is unique; it values equality and liberty, not as a mask but as a core principle."
- "Constructive dialogue between the Union and States is vital for federalism to thrive."
- "Courts play a key role in shaping and safeguarding federal principles."

4.Water Hyacinth Plant into Eco-Friendly Handicrafts

The **Krishna district administration,** in collaboration **with Lepakshi Handicrafts** and the Andhra Pradesh Handicrafts Development Organisation, is transforming the **invasive water hyacinth plant into eco-friendly handicrafts**. Led by national award-winning artisan **Rita Das**, this initiative provides rural women with skill-building workshops, converting environmental issues into economic empowerment opportunities. The training program, inaugurated by **District Collector DK Balaji,** aims to address ecological concerns, create self-employment, and boost local craftsmanship.

5.95% of Land Records in Rural India Digitized

Rural India is shifting to digital land records, bringing a new way to manage and own land.

- **Major Progress Since 2016:** Around 95% of rural land records are now digitised, ensuring land ownership is more secure and easier to access for people in rural areas.

Digital India Land Records Modernization Programme (DILRMP)

- **Program Overview:** DILRMP, formerly the National Land Record Modernization Programme.
  - It was restructured in 2016 as a **Central Sector Scheme**, funded by the central government.
- **Goal:** Establish a transparent, real-time land information system to improve land use, support policy-making, and streamline transactions.
- **Advantages:** Reduced land disputes, minimized fraudulent transactions, data sharing with other agencies, and fewer visits to physical offices.

Key Initiatives under DILRMP

- **Unique Land Parcel Identification Number (ULPIN):**

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- Each land parcel receives a 14-digit alphanumeric code based on geo-coordinates.
- Implemented in 29 states/UTs, it aids in managing real estate, resolving disputes, and supporting disaster management.

- **National Generic Document Registration System (NGDRS):**
- Standardizes the registration process across India.
- Facilitates online document submission, payments, appointments, and searches.
- Adopted by 18 states/UTs, with data sharing in 12 others.

- **e-Court Integration:**
- Links land records with e-Courts for faster case resolution and fewer disputes.
- Approved in 26 states/UTs.

- **Transliteration of Land Records:**
- Records are translated into 22 languages from the Indian Constitution to overcome language barriers.
- Currently in use in 17 states/UTs.

- **Bhoomi Samman:**
- 168 districts across 16 states have achieved **"Platinum Grading"** for meeting core program requirements, including digitization of records and maps.

ANSWER WRITING

Q. "The dynamic interpretation of constitutional provisions should not unsettle the foundational federal balance." Critically analyse this statement in light of the recent Supreme Court verdict on the Centre-State jurisdiction over 'intoxicating liquors'.

The dynamic interpretation of constitutional provisions by the judiciary can impact the foundational federal balance between Centre and State. In India's federal structure, clear jurisdictional boundaries are essential to ensure cooperative governance. However, reinterpretations by the Supreme Court, such as the recent verdict on Centre-State authority over intoxicating liquors, have sparked debates on the judiciary's role in potentially unsettling federal principles.

Dynamic Interpretation of Constitutional Provisions Can Unsettle Federal Balance

- **Reallocation of Jurisdictional Powers:** Judicial reinterpretation can shift powers initially assigned to states, disrupting the **division** of **legislative authority**.
  For instance: The recent Supreme Court verdict altered states' control over industrial alcohol, redefining '**intoxicating liquors**' beyond traditional meanings.
- **Infringement on State Autonomy:** Expanding central oversight through dynamic interpretation can **limit state authority** in sectors crucial to their revenue, impacting fiscal independence.
  For instance: The shift from state control to central regulation of **industrial alcohol** potentially limits states' ability to generate excise revenue.
- **Uncertain Legislative Intent:** Revising interpretations of constitutional entries without clear legislative direction can lead to **ambiguity** in law, affecting consistent policy application.
- **Potential for Centralisation:** Dynamic interpretations can **centralise powers** by expanding the Centre's regulatory domain, weakening the federal balance designed to empower states.
- **Legal Conflicts and Confusion:** Differing judicial interpretations of the same provisions over time may **create legal conflicts** and disrupt policy consistency across states.
- **Fiscal Implications for States:** Loss of regulatory authority limits states' ability to **raise revenues**, undermining their financial independence and impacting local governance.
  For example: States heavily reliant on **alcohol excise tax** for funding public welfare may face revenue shortages under expanded central regulation.
- **Impact on Cooperative Federalism:** Judicial overreach in reinterpreting state subjects can erode **cooperative federalism** principles, fostering conflicts rather than collaboration between Centre and State.

Measures to Prevent Cases of Unsettled Federal Balance

- **Clear Legislative Definitions:** Enacting precise definitions in **concurrent** and **state lists** can limit judicial reinterpretation and provide clarity in Centre-State jurisdiction.
  For example: Explicit **definitions** of 'intoxicating liquors' and 'industrial alcohol' would prevent frequent reinterpretations.
- **Strengthening Judicial Review Mechanisms:** Creating **specialised benches** or committees to evaluate cases with federal implications can ensure balanced interpretation aligned with federal principles.
- **Regular Constitutional Amendments for Clarity:** Periodic amendments to the Constitution, reflecting **contemporary realities**, can address ambiguous entries and reduce dependency on judicial interpretation.

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- **Promote Cooperative Mechanisms:** Establishing federal forums for Centre-State dialogue on **interpretative issues** can enable collaborative decision-making without judicial overreach.
  For instance: Regular meetings of the **Inter-State Council** could preempt judicial intervention in contentious federal matters.
- **Enhanced Training for Judges on Federal Principles:** Integrating comprehensive federalism training in **judicial education** can sensitise judges to the implications of dynamic interpretation on state autonomy.
- **Setting Precedential Stability in Federal Cases:** Encouraging adherence to **settled precedent** in federal disputes prevents abrupt shifts in interpretations that affect state rights.
- **Promote Stakeholder Consultation:** In cases with federal impacts, consultative input from **Centre, states,** and **policy experts** before final judgments can ensure a balanced perspective.
  For example: Seeking state opinions in cases affecting state subjects like **alcohol regulation** enhances inclusive decision-making.

Dynamic judicial interpretations of constitutional provisions can challenge the federal balance, potentially impinging on state autonomy. Clear definitions, robust federal forums, and consultative processes are essential to uphold cooperative federalism and protect foundational principles. As India continues to evolve, judicial restraint and legislative clarity will play pivotal roles in sustaining the Centre-State equilibrium crucial to India's democratic framework.

MCQ

1. What is the primary objective of the Srijan Center for Generative AI launched by IndiaAI and Meta at IIT Jodhpur?
   a) Developing AI models exclusively for commercial use in global markets
   b) Building proprietary AI models to protect India's AI advancements from international sharing
   c) Training young developers to create solutions using open-source AI models for real-world challenges
   d) Providing AI solutions specifically for rural development without research collaboration
2. Consider the following statements about the partnerships and research goals of Srijan Center for Generative AI:
   1. Srijan collaborates with both national and international institutions to advance Generative AI.
   2. The center solely focuses on developing AI models for healthcare applications.
   3. The All India Council for Technical Education (AICTE) is a supporting partner for this initiative.
   How many of the above statements is/are correct?
   a) Only one
   b) Only two
   c) All three
   d) None
3. Consider the following statements regarding the Indian Space Research Organisation (ISRO) and the Department of Biotechnology (DBT) bio-experiment agreement:
   1. The agreement includes studies on the effects of space radiation on astronaut health.
   2. Bio-manufacturing in deep-sea habitats is a key focus of the BioE3 initiative under the agreement.
   3. The research aims to explore algae as a nutrient-rich food source and for biofuel production.
   How many of the above statements is/are correct?
   a) Only one
   b) Only two
   c) All three
   d) None
4. Consider the following statements:
   1. The World Health Organization (WHO) has set the safe limit for particulate matter (PM2.5) at 15 micrograms per cubic meter over 24 hours.
   2. Condensation of water vapor is the primary mechanism by which PM2.5 forms in the atmosphere.
   Which of the statement(s) given above is/are correct?
   a) 1 only
   b) 2 only
   c) Both 1 and 2
   d) Neither 1 nor 2
5. Which one of the following statements best describes the term 'digital arrest'?
   a) A restriction imposed by governments on the development and implementation of artificial intelligence to prevent data misuse and algorithmic bias.
   b) A cybersecurity measure where a device or network is temporarily isolated to prevent further spread of malware or a cyberattack within a system.
   c) A scam where cybercriminals create fake digital arrest warrants to pressure individuals into paying fines for alleged online offenses.
   d) A scam where fraudsters impersonate law enforcement officials to intimidate victims into transferring money by threatening arrest.

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6. Consider the following pairs:
Space Missions ----------Features
1. Chandrayaan-4---------- Collect and return lunar samples to Earth
2. Lunar Polar Exploration Mission (LUPEX)---------- Explore water resources on the Moon's polar regions
3. NASA-ISRO Synthetic Aperture Radar (NISAR) satellite----- Observe Earth's complex processes using radar imaging
Which of the above pairs are correctly matched?
a) 1 and 2 only
b) 2 and 3 only
c) 1 and 3 only
d) 1, 2 and 3

7. Consider the following statements:
1. One carbon credit gives a licence to emit 1,000 kg of carbon dioxide or equivalent.
2. In India, the Bureau of Energy Efficiency (BEE) is the administrator for the Indian carbon market under the Carbon Credit Trading Scheme (CCTS).
3. The Paris Agreement has set up an international carbon market as part of helping countries meet their emissions targets. Which of the statements given above are correct?
a) 1 and 2 only
b) 2 and 3 only
c) 1 and 3 only
d) 1, 2 and 3

8. With reference to the Nature Conservation Index (NCI), consider the following statements:
1. It is designed to evaluate conservation efforts across countries using various indicators related to biodiversity protection and sustainable development.
2. It considers both terrestrial and marine conservation efforts.
3. In its 2024 report, India was ranked one of the poor performing countries in the conservation of biodiversity.
4. An increase in population density in protected areas would most likely improve a country's NCI score.
How many of the statements give above are correct?
a) Only one
b) Only two
c) Only three
d) All four

9. Consider the following pairs:

Sea Weeds	Application
1. Gelidiella acerosa	Source of agar
2. Sargassum spp	Production of alginate
3. Ulva lactuca	High Protein content

How many of the above pairs is/are correctly matched?
a) Only one
b) Only two
c) All three
d) None of the above

10. Flue Gas Desulfurization (FGD) is primarily used to reduce which of the following pollutants from thermal power plant emissions?
a) Particulate matter
b) Sulfur dioxide (SO_2)
c) Nitrogen oxides (NO_x)
d) Carbon monoxide (CO)

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